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The "Great" Price Spike of '93: An Analysis of Lumber and Stumpage Prices in the Pacific Northwest

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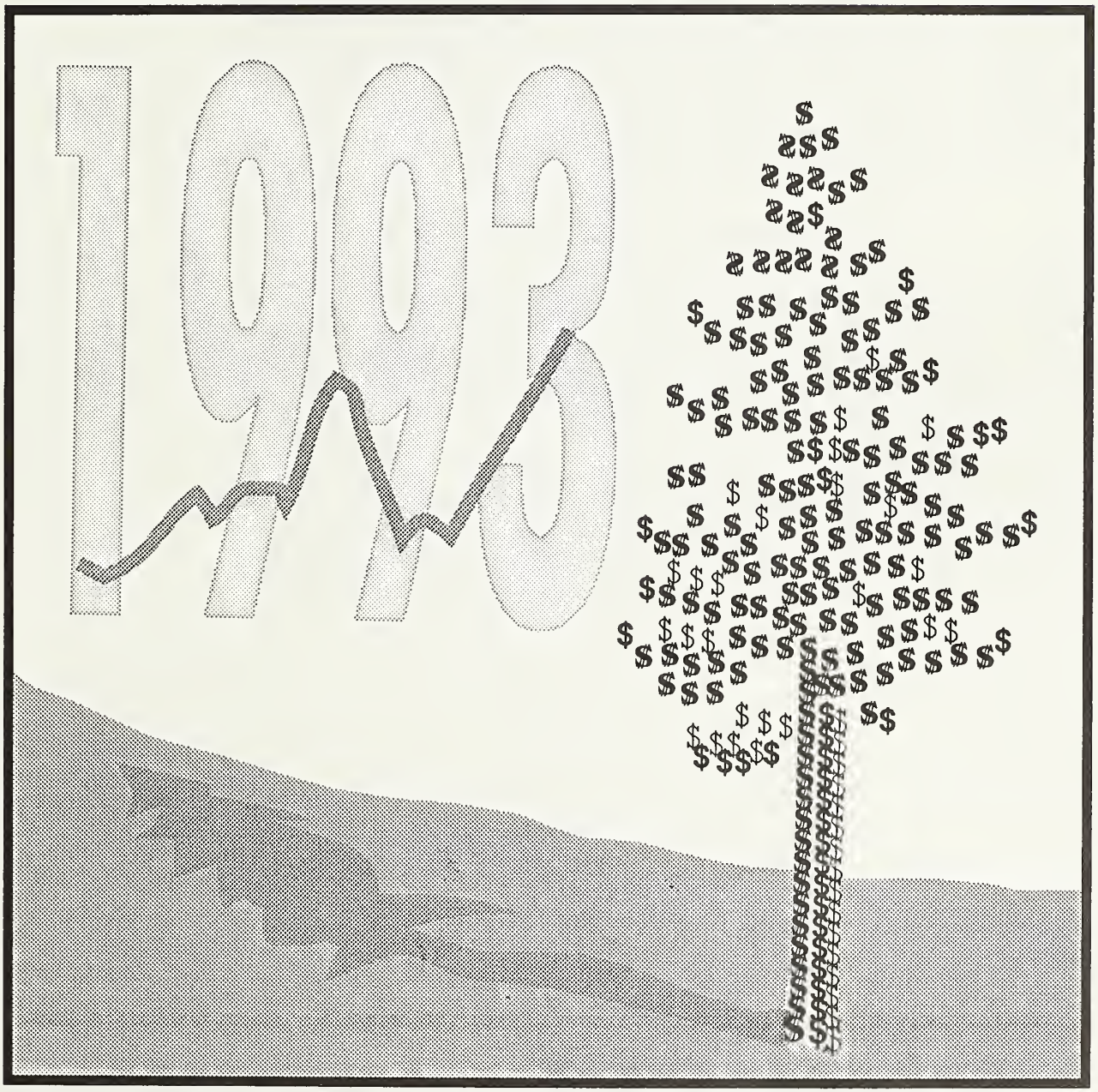

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Abstract

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Lumber prices for coast Douglas-fir (*Psuedotsuga menziesii* (Mirb.) Franco var. *menziesii*) swung rapidly from a low of $306 per thousand board feet (MBF) in September 1992 to a high of $495/MBF in March 1993. This price spike represented a sizable increase in the value of lumber over a short period, but it was not the historical anomaly that many in the media would suggest. Using the theoretical relation between lumber and stumpage prices, we analyzed the interaction between these two markets over the past 82 years. Among our major findings were that there are distinct seasonal variations in monthly lumber and stumpage prices; over the longer term, these markets can be divided into three different periods—1910 to 1944, 1945 to 1962, and 1963 to 1992; the most recent price spike did not match previous spikes in real terms; and the traditional lumber and stumpage price interaction became more significant with time but it does not seem to be as pronounced when we look at monthly prices.

Keywords: Price, price spike, stumpage, Douglas-fir, seasonality

Summary

From 1989 to 1993, lumber and stumpage prices for Douglas-fir in the Pacific Northwest fluctuated considerably. Although many price spikes can be attributed to specific causes, such as the controversy surrounding old growth, such simple explanations often belie the more complex nature of the economic processes that interact to form market prices. In this paper, we assess the factors influencing price movements over the past 80 years in Douglas-fir lumber and stumpage markets of the Pacific Northwest.

From a yearly series of stumpage and lumber prices for Douglas-fir dating to 1910 and a monthly series dating to 1982, we analyzed several components of prices: trend, cycle, seasonality, and randomness. Additionally, we were able to assess the large events affecting these markets at different points in time. Doing this gave us insight to how these prices have evolved given market activity.

Introduction

Media attention in the early 1990s focused significantly on the scientific and social issues associated with forest management. From endangered species protection to the price of building homes in a recovering economy, forestry issues garnered national and international attention. The media tend to sensationalize these problems, but sound economic arguments often can be used to help explain the issues.

The abrupt increase in the price of coast Douglas-fir (*Pseudotsuga menziesii* (Mirb.) Franco var. *menziesii*) lumber in winter 1992 represented a situation where hype generated by uncertain markets led to concern over the proper functioning of these markets. Throughout much of 1992, lumber prices were at levels higher than their recent historical average. Beginning in November 1992, though, lumber prices began a rapid increase that lasted for 4 months. By March and April 1993, prices were receding back to the levels observed in 1992.

Periods of rapid price increases are not uncommon in the history of markets, particularly commodity markets. Hysteria surrounding new oil discoveries near the end of the 19th century led to speculative land purchasing booms in much of the oil country of Texas. While of short duration, these booms often had an incredible impact on the price of land.

An example closer to home is the price of fruit and vegetables, such as oranges or lettuce, when sudden changes in weather threaten to destroy entire crops. Other agricultural commodities are similarly affected. Although price spikes like this often are associated with price increases, it does not always have to be that way. Sudden decreases are equally possible. A pointed example, albeit not from a commodity market, is the incredible 1-day decline of the stock market on October 19, 1987.

Erratic price behavior is an issue that can greatly affect people's lives. But there are two relevant questions: Why are prices so important that we should worry about these rapid changes? and What (or who) is to blame for these rapid changes? The answer to the first question lies in the role of prices in the economy. Prices are the ultimate regulator of everything people do. As such, when prices change rapidly, we have to adapt our behavior quickly to ensure that we do not experience rapid changes in our own welfare. Sometimes, we cannot adapt quickly enough, and sometimes it is impossible to adapt.

Because prices are such an important part of everything people do, erratic or rapid changes create concern over the potential causes. This, of course, leads us to the second question regarding the forces at work. Economists traditionally suggest that several different exogenous factors can cause prices to increase or decrease rapidly. They include actual or expected supply shortages, such as the events surrounding the energy crisis in the early 1970s; speculation of future value, which often occurs in commodities markets; abrupt policy shifts on the part of a government; or even demand shocks.

Although these factors each may play a part in explaining price behavior, a more thorough analysis suggests that we look at all components of a price. When we decompose a price, it becomes a function of trend, cycle, seasonality, and randomness (Makridakis and others. 1978). Trend suggests whether prices generally increase or decrease over time. Cycle is the part relating to the business cycle in general; for example, some component of price is determined by the general level of economic activity at the time. Seasonality is a component causing prices to be either higher or lower during certain times of the year. Randomness represents all that cannot be explained by the other three parts. Price spikes usually are considered to have both cyclical and random components.

In the context of the 1993 price run-up, we explored these components separately. Rather than viewing the lumber market exclusively, however, we also considered the timber stumpage market, as stumpage demand basically is derived from lumber demand. To do so, we first developed a simple model of the relation between stumpage and lumber. Analyzing stumpage may provide additional insight to the pricing issue.

A complex set of factors interacts to set the price of both stumpage and lumber. Ordinarily, economic theory suggests that lumber and stumpage prices should move together over time; but what we find is that there are some very conspicuous dissimilarities. The erratic behavior that gained so much attention throughout 1993 is one example of prices that did not behave as theory predicted.

Including the analysis of stumpage prices allowed some historical perspective with a rather unique set of price and volume data dating back to 1910. This information has not been published previously, and it provided a rich set of data with which to view timber markets. Throughout this paper, then, we will refer to two sets of price series. The first set is a monthly series of coastal mill Douglas-fir lumber prices (Western Woods Product Association 1982-1992) and Pacific Northwest (PNW) west-side National Forest stumpage prices (Haynes 1991), running from January 1982 to December 1992. The second set is a yearly series of cut and sold stumpage price and volume[1] and lumber prices[2] running from 1910 until 1992.

Using the framework above, where price is expressed as a function of trend, seasonality, cycle, and randomness, we first analyzed the trend component. By delving into both the shorter, 11-year time series (1982-92) and the longer series (1910-92) discussed above, we found that an upward trend has occurred historically in the prices of both lumber and stumpage. Although there were periods when prices remained relatively stable for many years, the overall trend was up.

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[1] Cut and sold price and volume data from 1910 to 1992 is from Pacific Northwest Region National Forest timber sales data. Specific information relating to series construction can be obtained directly from the authors.

[2] Lumber prices from 1910 to 1972 are from USDA (1973), appendix V, table 2, p. 332. Lumber prices from 1973 to 1993 are coastal Douglas-fir prices from the Western Wood Products Association, Portland, Oregon.

In addition to the trend, there was a relatively strong seasonal component to both stumpage and lumber prices. Haynes (1991) shows seasonality in stumpage prices, and here we used similar monthly time series data of prices for 1982 through 1992 to show that the prices for lumber have seasonal patterns as well. Cycle and randomness will be considered together, as there is reason to believe that many of the random components can be partially explained by cyclic events in the economy as a whole.

Prices Over the Past 10 Years

Price spikes are not a new phenomenon. They tend to capture the public's attention as they occur, but they in no way represent new aspects of the timber market. The data for both stumpage (Haynes 1991) and lumber over the years 1982-92 show many instances of such behavior. Calling on the exogenous factors discussed above, as well as cyclic phenomena, we can explain much of the random component.

Rapid price increases, although economically important, historically have been short-lived phenomena tending to cause more raised eyebrows than disastrous consequences. This does not mean that price spikes cannot significantly alter economic welfare; rather, it illustrates the point that these events are a part of economic history and likely will be with us well into the future.

The lumber price run-up over the 1992-93 winter, for example, increased prices well above any price hikes in the previous 10 years, but prices have declined significantly since then. One of the more popular explanations is that speculative behavior over the impending forest summit among industry groups, environmental groups, and President Clinton, held on April 2, 1993, caused this spike. Investors and manufacturers alike were uncertain as to how timber harvests would be affected by this conference. The actual spark that began the price increase may even have been the election of the new President and Vice President, both considered to be sympathetic to environmental groups.

Figure 1 shows that there seems to be some significant structural change in the movement of prices before 1989 and after 1989. More than likely, this structural shift is correlated to the increased legal activity, after 1989, surrounding the northern spotted owl (*Strix occidentalis*), and related land management issues.[3] With the exception of the price increase in late 1982 and early 1983, the most drastic price fluctuations seem to have occurred during and after 1989.

To analyze structural shifts, we developed a simple model to capture the relation between lumber and stumpage prices. This model was used for both the long-term and

[3] Throughout this article, we refer to the "old-growth" controversy. In contemporary news stories, the spotted owl has become the most visible component of the myriad of controversies in the Pacific Northwest and has become an indicator of the entire controversy that has developed since 1989 concerning land management issues in the Pacific Northwest.

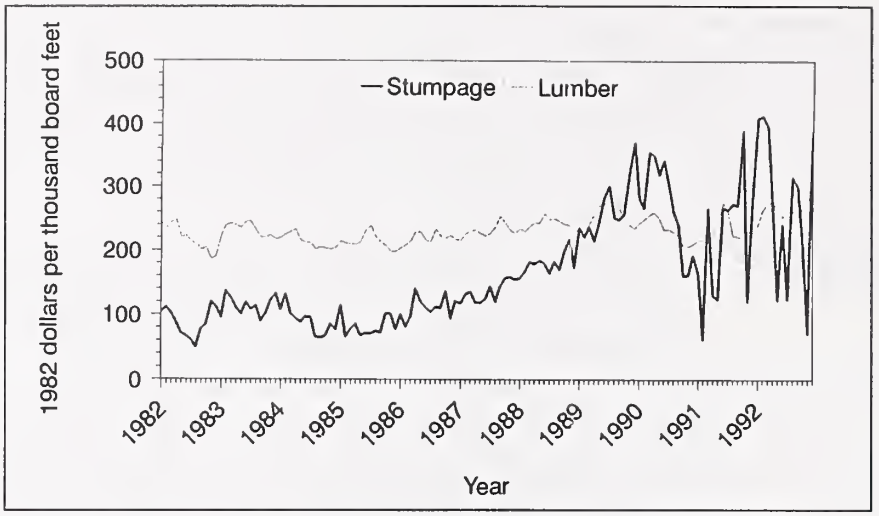

Figure 1—Real monthly prices of coast Douglas-fir lumber and PNW west-side National Forest sold stumpage.

the monthly price series. Conceptually, stumpage prices should be a function of lumber prices, because stumpage demand is derived from the demand for lumber and other products. We can model stumpage prices as:

$$P_{stump} = f(P_{lum}, P_{ply}, P_{logex}, costs) , \quad (1)$$

where P_{stump} is the price of stumpage, P_{lum} is the price of lumber, P_{ply} is the price of plywood, P_{logex} is the price of log exports, and costs are the manufacturing costs associated with the process of turning stumpage into lumber or plywood.

To examine some of the properties of the price series, we estimated the relation between the stumpage price and the lumber price. This is the regression,

$$P_{stump,t} = b_0 + b_1 P_{lum,t} + error_t , \quad (2)$$

which should capture the effect lumber price historically has had on stumpage price. Additionally, we used a chow test to determine if there have been distinct time periods when these relations have differed. Table 1 gives the results of the regression equations and the chow tests.[4]

Figure 1, which focuses on the monthly series, suggests that the majority of significant lumber price spikes of the last decade have occurred since 1989. Lumber prices peaked during 1989, perhaps because of concern and speculation over the significant reduction in timber sales from PNW west-side National Forests during that year. Prices retreated for most of 1990 due to recessionary tendencies, although the small spike in that year may have been spawned by considerable concern that volumes sold from National Forests in the PNW west-side region would be constrained even more in the future. These concerns never materialized, however, as 1990 sales volumes were close to record levels.

[4] A chow test allowed us to test for meaningful structural breaks in the time series we used for regression analysis. A good discussion of this can be found in Kmenta (1986: 420-21).

Table 1—Results of regression analysis

Monthly data	Sample period	Constant	Lumber price	AR(1)	MA(1)	DW[a]	R^2
(1) Cut stumpage price	1982.02 - 1993.02	104.57	0.24	0.95	-0.59	1.98	0.58
		(0.67)[b]	(0.50)	(9.93)	(-4.66)		
(2) Cut stumpage price	1982.02 - 1990.06	5591.20	.26	1.00	-.57	1.80	.91
		(0.00)	(1.02)	(21.84)	(-4.81)		
Yearly data							
(3) Cut stumpage price	1910-92	-1455.73	.18	1.00	—	1.70	.96
		(-.02)	(4.12)	(32.52)			
(4) Sold stumpage price	1910-92	-63.54	.70	.86	—	1.84	.88
		(-2.04)	(6.21)	(13.75)			
(5) Cut stumpage price	1910-44	614.72	-.04	1.00	.37	1.98	.83
		(.01)	(-1.79)	(12.65)	(2.08)		
(6) Sold stumpage price	1910-44	3.62	.10	.60	—	2.27	.49
		(.67)	(2.34)	(3.95)			
(7) Cut stumpage price	1945-62	91.38	-.09	.89	-.36	1.91	.80
		(2.38)	(-0.95)	(7.53)	(-1.26)		
(8) Sold stumpage price	1945-62	-47.17	.40	.64	—	1.85	.66
		(-1.36)	(3.07)	(2.89)			
(9) Cut stumpage price	1963-92	372.88	.34	.99	—	1.83	.88
		(.185)	(4.60)	(12.76)			
(10) Sold stumpage price	1963-92	-76.32	.89	.74	—	1.81	.72
		(-1.11)	(3.58)	(5.26)			

	Sample period	Constant	Time trend	DW	R^2
(11) LN (cut stumpage)	1910-92	2.11	.037	.26	.70
		(31.48)	(26.83)		
(12) LN (lumber price)	1910-92	4.54	.016	.27	.90
		(82.89)	(13.76)		

— = moving average term not included in the regression.

[a] DW represents the Durbin-Watson statistic.

[b] The t-statistics are included in parentheses below the coefficient estimates.

In February and March 1991, another lumber price run-up with roots in the old-growth controversy began. Judge Dwyer issued his sweeping injunction,[5] a move that drastically reduced PNW west-side National Forest timber sale levels from 3380 million cubic feet of sales in 1990 to a mere 297 million cubic feet in 1991 (Warren 1993). Although lumber companies theoretically have inventories from which to draw timber for cutting purposes, speculative behavior by lumber buyers combined with uncertainty about the future no doubt contributed much momentum to the fast run-up of prices in the middle of 1991.

Markets predictably settled down in the postinjunction period, but it was not long before another period of rapid lumber price inflation began in late 1991 and early 1992. This price run-up most likely began in anticipation that the Bureau of Land Management would not gain exemptions under the Endangered Species Act for 44 timber sales (the "God Squad" hearings were held in early 1992).[6] When the ruling came out (granting partial exemptions), there was continued upward price pressure, as future National Forest timber sales and harvests were projected to be lower. Peaking in February and March 1992, prices began to recede during the summer months, due partly to seasonal influences, which tend to lower summer lumber prices (seasonality is discussed in depth later in the paper). Interestingly, lumber prices never declined to their lows of 1990. Rather, the low point between the peak early in 1992 and the run-up of 1992-93 seems to have increased about $50 per thousand board feet, a consequence, no doubt, of the prolonged battle between timber and environmental interests in the old-growth controversy.

An additional explanation has been suggested for the price spike of 1992.[7] At that time, there was much concern over a potential countervailing duty on Canadian lumber imports. This dispute arose over Canada's withdrawal from the 1986 U.S.-Canada Softwood Lumber Memorandum of Understanding. A U.S. Commerce Department preliminary ruling came out in March 1992 and suggested there were substantial Canadian subsidies. Concern over the possibility of a resulting countervailing duty may have led to increased prices at the time.

The roller coaster ride in monthly lumber prices from 1989 to 1993 was also mirrored in the stumpage market where prices for stumpage have increased and decreased dramatically, often in the space of one or two months. As with lumber markets, most of these exceptionally large changes can be explained by the environmental conflict being played out in the Pacific Northwest.

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[5] Seattle Audubon Society v. Evans, 771 F. Supp. 1081, 1091 (W.D. Wash. 1991).

[6] These were the hearings of the Endangered Species Committee, U.S. Department of the Interior, held in response to the Oregon Bureau of Land Managment's request for exemption from the requirements of section 7(a)(2) of the Endangered Species Act for 44 FY 1991 timber sales.

[7] Personal correspondence. 1993. Ross Gorte, Congressional Research Service, The Library of Congress, Washington, DC 20540.

Even before 1989, stumpage prices did not display the same type of behavior as did lumber prices. Although there are significant fluctuations in the price from 1982 to 1993, except for late 1982, there are no sustained periods of price increases or dramatic changes. By looking at the regression of stumpage on lumber prices for January 1982 to June 1990, we see that this period has a much better fit than does the full period. The R^2 values from the first two regressions in table 1 illustrate this structural change. When the entire time series is used, the R^2 value is significantly lower than when only the data from 1982 to the middle of 1990 are used. Indeed, a chow test pinpoints the time of the structural shift in the relation between lumber and stumpage prices to the middle of 1990 (table 1). This corresponds roughly to our intuition that 1989 was a watershed year due to the increased number of lawsuits surrounding the old-growth controversy.

Another way to look at the relation between lumber and stumpage prices is to consider the elasticity of price transmission (George and King 1971), which has important implications for modeling forest sector economic activity as studied by Haynes (1977). Haynes calculated the elasticity of price transmission between lumber markets and stumpage markets in the Pacific Northwest. The elasticity of price transmission compares the relative change in lumber price to the relative change in stumpage price. It measures the effect of lumber prices on stumpage prices. Although computed from pre-1977 data Haynes found that the elasticity of price transmission was 0.38 for west coast lumber. This implies that a $1 change in the price of lumber will lead to a $2.63 ($1÷0.38) change in the price of stumpage.

The elasticity of price transmission is illustrated in figure 1. Stumpage prices tend to fluctuate considerably more from period to period than do lumber prices. Small changes in the lumber markets have larger impacts in the stumpage markets; this is especially obvious after 1989.

In addition to the particular events causing price spikes in lumber markets, seasonal factors seem to impact prices in both stumpage and lumber markets. Using standard econometric software to deseasonalize the price series, we found that lumber prices in late winter, spring, and summer are overstated and those in the late fall and early winter are understated. As for the stumpage markets, Haynes (1991) shows that for 1975 to 1989, late fall and winter stumpage prices overstate actual prices, and summer prices understate actual prices.

Seasonality

Seasonality itself is an interesting concept to consider. One looks for patterns in the price series that are repeated at fixed intervals over a certain time. To remove seasonality, seasonally high price periods are averaged with seasonally low price periods. An important question to ask is, If prices are consistently high in a certain period and low during another, why won't people buy the products earlier to take advantage of the lower prices? This type of practice should eliminate any seasonality, because price arbitrage would work to equalize prices in the different time periods.

Although the above discussion suggests that seasonality should not exist, why is it seen in lumber and stumpage prices in the Pacific Northwest? One explanation may be that the market is structured to facilitate seasonal variations. For example, it is well known that logging is more difficult in winter, a fact that helps explain seasonally high stumpage prices during the winter months. Limitations in log storage capabilities of lumber mills helps explain why they do not purchase enough logs during the summer months to supply them during winter. Finally, there is the possibility that lumber may be degraded if logs are stored too long.

This explanation probably suffices for the stumpage market, but is there a comparable explanation for the lumber market? The lumber market seems to be more complex in its seasonal variation than is the stumpage market. Because lumber is a significant component of new housing starts and houses are begun mostly during spring and summer months, this period may be one of exceptionally high demand compared to the rest of the year. Logs, however, are easier for mills to acquire during the summer months, which implies that both production and lumber supply should be higher during this time and, thus, prices lower.

Because supply and demand suggest two opposite answers to the seasonality in lumber prices, we went a step further and considered the storage issue: Will builders or local lumber distributors warehouse lumber during periods of seasonally low prices? We analyzed new orders and inventories of lumber products from Oregon and Washington coast mills (Western Wood Products Aassociation 1982-1993). Seasonal correction factors are given in the table 6 (appendix).

In new orders, there is anticipation of summer building beginning with seasonally higher orders in March. Orders remain overstated until June, when most new houses presumably have been framed and the demand for lumber falls off. Another increase in orders occurs during fall, however, and is attributed to other end uses of lumber such as sports equipment, games and toys, commercial and industrial equipment, and pallets (Haynes 1990). Orders increase in anticipation of Christmas shopping. These same seasonal fluctuations are found in inventories.

This information suggests that end-use markets for lumber, while anticipating the summer building season, do not adjust their purchasing habits by stocking their inventories during winter months when prices are at their seasonal lows. One explanation may be that warehousing costs for large amounts of lumber are prohibitively expensive. Another explanation may be the difficulty of anticipating how extensive the summer building season may be. The mills themselves, for example, do not build significant inventories in the months before demand begins to expand; their buildup in inventory precedes the summer building boom by a month but does not anticipate the winter boom at all. The implication seems to be that the uncertainty in the market prohibits manufacturers and builders alike from fully anticipating the seasonal factors.

Over the period of our analysis, 1982 to 1993, there was no discernible trend in lumber prices. The range of fluctuations has remained relatively constant during that period. In stumpage markets, however, there does seem to be a trend showing an increase between 1986 and 1990. Despite the increasing real prices during the late 1980s, stumpage prices only recently have broken the historical highs (discussed in the next section) of the late 1970s. The price growth throughout the 1980s probably reflects the rapid rate of expansion of the economy in general.

Prices Over the Long Term

Equally as important as monthly prices, and equally as interesting to consider, are prices over a longer period. Here we offer a unique set of stumpage prices and volumes cut and sold from PNW west-side National Forest land between 1910 and 1992. Information is available on the volume and the average price at which the lumber was sold and the actual average price paid for the timber cut during a given year. The full price series, as well as references, is given in the appendix.

Figure 2 shows these long-term lumber and cut stumpage price series, and figure 3 shows the long-term lumber and sold stumpage prices. The cut price of stumpage reflects the average price of stumpage that actually is removed from the woods during a given year, and the sold price is the average value of all timber sales during that year. Essentially, the cut price is a volume-weighted average of a number of previous timber sales. In cut and sold stumpage and in lumber, long-term prices have been increasing over time.

What is perhaps most striking about figure 2 is that lumber prices display greater fluctuations than do cut stumpage prices. Although we earlier suggested the opposite to be true, this result can be explained by referring to our discussion of the elasticity of price transmission. We calculated the relation of lumber prices to stumpage prices for the period from 1910 to 1992 to be 0.41 for cut stumpage and 0.37 sold stumpage. This means that a 1-percent change in the price of lumber will cause a 2.4-percent change in the price of cut stumpage and a 2.6-percent change in the price of sold stumpage. Because stumpage prices are lower than lumber prices, their absolute changes do not have to be as great to make their relative changes larger than in lumber markets. Interestingly, the elasticity of price transmission calculated from this long-term data set is virtually the same as that calculated by Haynes (1977). Although the differences may not be significant, this verifies the data shown in figures 2 and 3, that sold stumpage prices are more volatile than cut stumpage prices.

From the model of the relation of stumpage and lumber prices developed in the previous section, we can test for structural shifts in the long-term price series. The regression of both cut and sold stumpage over lumber prices allows us to test the hypothesis that there are structural shifts in the relation in 1944 and 1962. Sound external reasons, discussed below, cause us to believe that these years represent breakpoints in the data.

Chow tests on regressions (3) and (4) from table 1 indicated the significance of 1944 and 1962 as breakpoints (see table 2). We also break the regressions into separate periods (regressions 5 through 10 in table 1). Prior to 1963, only the sold stumpage price is significantly related to the lumber price. After 1963, both cut and sold stumpage prices are significantly related to lumber prices.[8]

Another test (recursive least squares) identifies only one shift in the late 1950s and early 1960s in the relation between stumpage and lumber prices. Because this method compares all past years to the very next year, it does not look far enough ahead to assess long-term structural shifts. Still, recursive least squares does provide independent confirmation of one of the structural shifts.

Several explanations are possible for these structural shifts. The first considers the way stumpage has been used over time. Until World War II, most stumpage was used in lumber. After that war, there were more and more varied products made from stumpage, such as plywood, and pulp and paper.

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[8] In all cases, the Durbin-Watson statistics were such that corrections for first-order autocorrelation needed to be made. In regressions five and seven, we also included a moving average term to tighten the regression. Information relating to the Durbin-Watson statistic or moving averages can be found in Kmenta (1986: chap. 8).

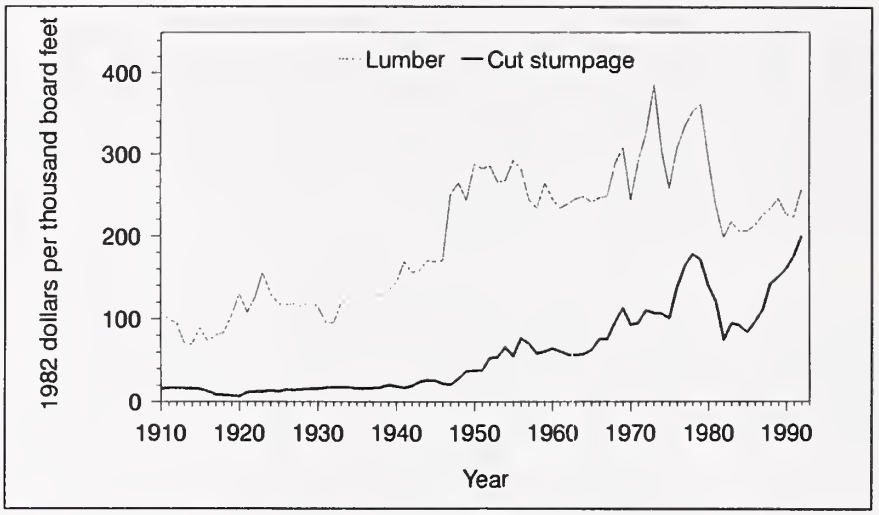

Figure 2—Yearly deflated price of coast Douglas-fir lumber and PNW west-side cut stumpage.

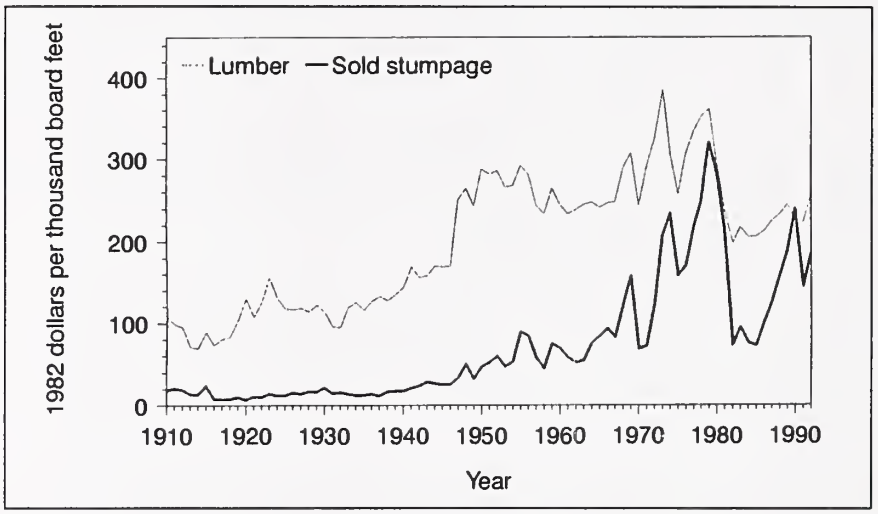

Figure 3—Yearly deflated price of coast Douglas-fir lumber and PNW west-side sold stumpage.

Table 2—Results of chow tests on period breaks

Regression number and period breaks	F-statistic	Degrees of freedom	
		Numerator	Denominator
(1) 1990.06	3.77	4	126
(3) 1944, 1962	4.30	3	73
(4) 1944, 1962	2.37	3	73

There also have been shifts in the way sales have been offered. In the early part of the 20th century, the Forest Service sold timber only if specifically asked by a local lumber mill or landowner. In the interest of stabilizing local economies, the Forest Service held timber back so as not to flood markets with cheap stumpage. There also may have been the additional problem that Federal lands could not be logged until more accessible lands were developed and roads were built. Early timber sales generally were characterized by the long duration of contracts, some lasting for 30 or more years.

A new era of Forest Service activity began in 1944 as Chief I.J. Mason proposed that the Forest Service become an active part of the timber supply.[9] Harvest quantities, which beforehand had been fairly static, began to increase rapidly. With these rapid harvest increases came increased volatility in the prices, as shown in figure 2. Harvests continued to increase until the early 1960s.

There may have been several reasons for the structural change in 1963. First, the Forest Service adopted new appraisal methods that tied stumpage values directly to end-product markets. Second, the post-World War II housing expansion continued to influence the market for housing materials. Third, the Forest Service could no longer continue increasing the sale program in the Pacific Northwest. The sale program peaked in 1965.

These distinct time periods can be analyzed. Figure 4 shows the period before 1944 as an extremely dense set of points near the origin of the graph. Remember, this was a time when sales were not promoted, so quantities were not very high and the adequacy of supplies kept prices from rising significantly. Although prices jumped immediately after 1944, by 1950 they had stabilized, and quantities began to increase significantly. The period between 1944 and 1962 may best be described as a transition period for the timber industry in the Pacific Northwest. During this time of phenomenal economic growth, Forest Service harvest quantities were expanding rapidly. Prices held steady because of harvesting of old growth and, perhaps, because of the methods by which prices were determined. Then came the big shift in 1962 to an end-product appraisal method. This point was marked by the highest cut volume from PNW west-side National Forests, as well as a fairly low price. After this, quantities remained consistently high, and prices increased.

Besides the dichotomy of three separate periods, another important distinction can be made about these prices—the idea of administered prices. Gardiner Means first expressed the idea of administered prices in testimony before the U.S. Senate in 1935 (Means 1935). The administered prices hypothesis suggests that industrial prices remain relatively fixed, even as economists suggest that free markets work continuously to change price structures. Although we will not definitively test that hypothesis here, our intuition suggests that before the early 1960s, administered prices indeed may have been the rule in timber stumpage prices. The regression analysis supports the administered price hypothesis as well. Before World War II, lumber price shifts

[9] Evaluation of Forest Service Timber Sales Activities. 1955. A report developed by the McKinsey company. On file with: Social and Economic Values Research Program, Forestry Sciences Laboratory, Pacific Northwest Research Station, P.O. Box 3890, Portland, OR 97208-3890.

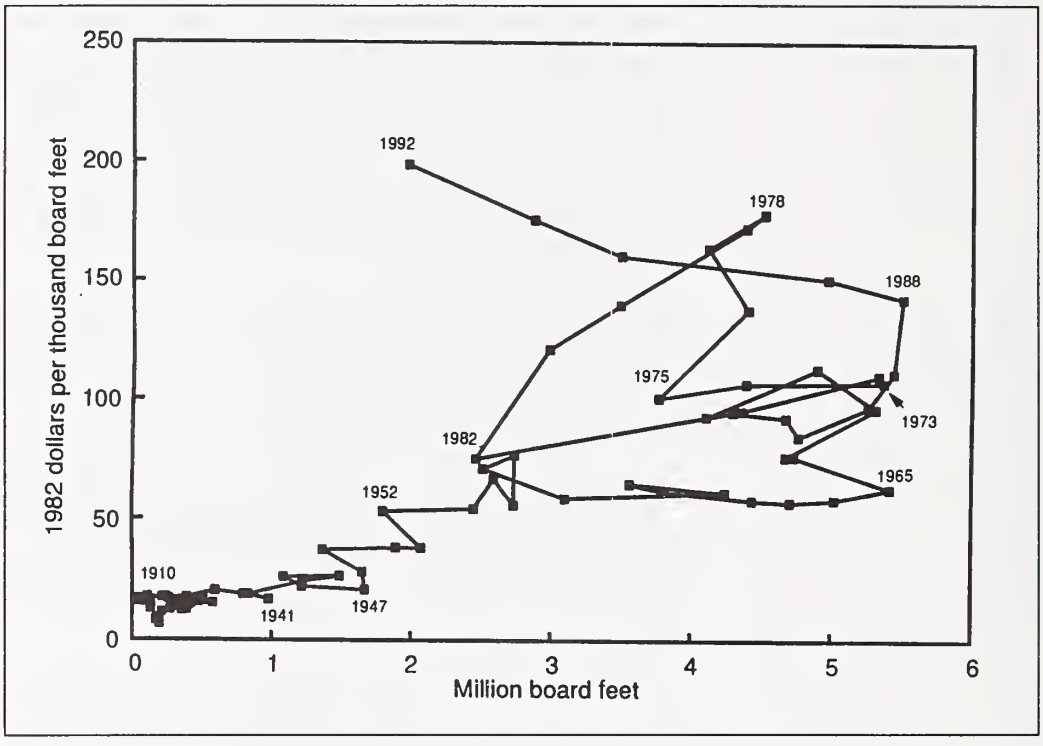

Figure 4—Deflated price vs. quantity of cut stumpage from PNW west-side National Forests.

explained very little of the shifts in stumpage price, contrary to the notion that stumpage demand is derived from lumber demand. The years between 1944 and 1962, as mentioned, were years of transition, and after 1963, lumber price changes gained significant power to predict changes in stumpage prices.[10]

Aside from the general structural changes discussed above, several other periods become noticeable when we look at the data, particularly the lumber prices. For instance, 1923 seems to stick out as a high point in prices before World War II. This point ends a period of eight or so years of increasing prices associated with the effort for World War I and the ensuing building boom (Warren and Pearson 1933). As suggested by Mills (1927), the years from 1909 to 1915 were years of relative stability, and those between 1915 and 1921 were fairly unstable.

The next period of interest is the dramatic increase in prices after World War II. These probably can be explained by the price controls imposed by the Roosevelt and Truman administrations during the war and the subsequent removal of these restrictions immediately after the war. This period of reinflation probably lasted until sometime in the 1950s and may reflect the effectiveness of the price controls during the war.

[10] We acknowledge, as well, that the lumber market may not have been as significant a factor in stumpage demand during the early part of the 20th century.

The next most noticeable periods of price fluctuations were during the late 1960s and the 1970s. The increase in 1969 occurred during the rapid expansion for the Vietnam war, when inflation and the economy were heating up simultaneously. The upward price pressure was relieved in 1970 with a mild economic downturn, when real gross national product (GNP) and housing starts declined. The economy again picked up in the early 1970s, but the peak in 1973 occurred as a result of the energy crisis spurred by Oil Producing and Exporting Countries (OPEC). Prices began falling again immediately after the energy crisis began, in spite of rapidly increasing producer and consumer price indices. This fall is related, as was that in 1970, to decreasing real GNP and dramatically decreasing housing starts. Interestingly, prices were declining after 1979, even as the producer price index was continuing to rise. Again, this price downfall can be explained by decreases in economic growth.

All three lumber price spikes in the post-1962 era are explained by economic activity in general. Prices increased dramatically during economic boom times, or after significant economic shocks, and fell rapidly during the bust times. The only time these fluctuations were seen in the cut stumpage prices was in the 1978-79 period. Stumpage prices had increased since 1965, but the cut prices accelerated only during the late 1970s. This reflected the intense inflationary pressures of the time. The sharp fall in cut prices after 1979 reflected the depth of the effect of the early 1980s recession on the forest industry.

It seems that the margin traditionally associated with turning stumpage into lumber eroded at several times in the recent price history. In 1980 and again in 1990, the price of sold stumpage met or exceeded the price of lumber, thereby indicating particularly thin (or negative) margins for lumber producers. In early 1980, this reflected buying by the mills of a large portion of recent timber sales for relatively high prices during a period of high lumber prices. When lumber prices began to retreat, producers were stuck with high-priced timber. They began to purchase new sales and asked the Federal Government for relief from their earlier contracts, which were made during highly inflationary times. This example again points out that the cut price is a more accurate indicator of stumpage prices, especially regarding margins; it reflects the price of wood actually coming off the land during that period.

The similar increase in sold prices during the late 1980s reflected an unprecedented demand for timber from Federal lands during a period of high economic growth. Unfortunately, there also was an increase in cut stumpage prices during this period and into the 1990s, which seemed to indicate a true reduction in the margins. This may have been a contributing factor to the increase in mill closings in the Pacific Northwest in the early 1990s.

A question often asked about long-term prices is, What is the overall trend? We have found, by regressing the natural log of the price series, either lumber or stumpage, over a constant and a time trend that both price series display a significant upward movement in prices over time. Since 1910, lumber prices have increased 1.6 percent annually, and cut stumpage prices have increased 3.7 percent annually. These increases were determined in real terms.

Figures 2 and 3 can be used to point out an interesting fact to those concerned about the recent price spike in lumber prices: although the prices rose dramatically over a few months, they did not compare to the prices during the late 1960s and 1970s. Of course, these are all real prices, so they are relative to the base year of 1982. They nevertheless point out that in the longer view of lumber prices, we have not come close recently to topping historical highs.

Conclusion

To return to our original premise: price run-ups are very much a normal part of our timber markets, even though they occasionally seem spectacular and cause intense scrutiny of market operations. Like markets for other commodities, speculative behavior combined with media attention tend to enhance a constantly adjusting and fluctuating price mechanism for lumber and stumpage. To be thorough, however, we have analyzed lumber and stumpage prices in a multidimensional way by assuming that they are some function of trend, cycle, seasonality, and randomness.

Over the past 80 years, there has been an upward trend in the prices of both lumber and stumpage. Cyclical and random components often have acted to accentuate price increases and decreases. Looking at monthly prices, we found a large seasonal component to both price series, with seasonal price increases and decreases occurring at opposite times of the year. Random components, in the monthly series, seem to be more important than the cyclical parts, or at least they are more obvious in the data.

Although random components, such as with the old-growth controversy and recent court cases, cannot always be foreseen, their effects suggest that similar issues should be anticipated in the future. Further, situations impacting the short-term supply outlook, need to be separated from issues impacting the long-term nature of supply. For example, resolution of the old-growth issue has both short- and long-term impacts. In the short term, reduced harvests from National Forest land in the Pacific Northwest lead to immediate increases in prices. In the longer term, one consequence of long-term harvest reductions will be to increase national prices, thereby leading to increased production in other regions. Eventually, this slows the rate price increases on a national level. In the longer term, price increases must be sustained if other regions all increase their production. Short-run price spikes do not have the same impact.

The old-growth controversy has spawned three short-term lumber price spikes over the past 4 years (1988-92). The long-run consequences are, obviously, not yet determined, but it is speculated that reduced harvest will lead to increases in price. This, in turn, should reduce lumber production in the Douglas-fir region and increase production elsewhere in the United States.

The price data published here provide a rich set of information for analyzing timber markets in the Pacific Northwest. This small amount of information can provide invaluable insight to the nature of timber markets in the region. From short-term spikes to the long-term trends, we can see how people involved with the market have made decisions in the past and how that information can be used to speculate about the future.

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Appendix: Data Sets

Table 3—Real monthly stumpage prices for the Pacific Northwest west-side National Forests[a]

	Year										
Month	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
	1982 dollars										
1	103.84	95.88	107.02	113.50	99.77	116.96	156.24	235.10	281.85	163.87	409.91
2	110.89	136.45	130.96	65.91	81.74	131.41	166.96	221.22	266.62	63.05	412.96
3	102.56	124.99	101.51	77.99	96.54	135.08	181.93	236.71	354.25	266.07	394.90
4	87.59	110.46	94.36	85.52	140.04	119.00	179.20	214.64	349.43	129.49	274.39
5	71.00	100.39	88.19	67.55	120.25	118.27	184.45	243.10	318.95	123.72	122.14
6	66.84	118.59	96.82	71.77	111.35	124.19	179.94	283.11	341.88	267.08	240.58
7	61.07	107.71	95.11	70.83	104.07	143.42	164.27	301.07	300.94	263.36	124.14
8	49.59	113.08	65.60	74.37	112.26	19.85	182.92	251.85	260.60	273.31	314.93
9	78.12	90.31	64.39	72.75	110.11	143.33	169.82	248.17	239.42	270.31	299.57
10	84.48	102.03	67.38	102.50	135.60	156.79	198.52	257.77	160.44	389.06	210.92
11	119.24	121.75	85.47	101.02	94.04	158.61	218.03	318.84	161.34	120.03	71.25
12	112.26	132.40	77.07	77.20	121.06	154.53	173.28	369.82	192.01	280.58	387.41

[a] Series was deflated by producer price index.

Sources: Data 1982-89 are from Haynes 1991; data 1990-92 are from Warren (1993).

Table 4—Real monthly lumber prices for Douglas-fir produced in the coastal area[a]

Month	Year											
	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
	1982 dollars											
1	243.20	220.94	219.03	214.41	203.51	215.95	234.29	233.73	242.58	216.28	239.24	314.70
2	235.25	239.56	224.71	211.06	208.70	225.93	229.90	229.65	248.31	215.14	262.73	347.97
3	243.26	241.76	228.61	210.40	214.79	230.63	237.88	240.85	255.83	214.21	274.87	
4	246.98	239.49	233.20	208.97	229.86	232.19	243.19	257.97	259.87	221.52	275.73	
5	220.01	235.01	215.66	213.32	228.28	226.85	243.30	270.68	250.56	240.68	264.33	
6	222.41	244.11	212.45	231.65	215.91	222.52	257.86	273.24	232.86	275.17	253.22	
7	212.49	245.17	212.12	238.27	213.55	227.02	248.77	278.67	233.28	260.75	252.82	
8	210.69	231.92	201.94	220.68	233.11	237.37	250.17	275.51	229.05	223.70	258.99	
9	201.08	220.10	205.16	213.06	221.99	253.23	246.02	266.39	222.94	221.95	276.54	
10	204.53	220.80	203.42	207.32	219.26	242.58	241.55	249.14	207.26	218.42	259.49	
11	186.48	223.64	201.59	198.43	222.88	231.54	239.33	241.05	206.59	219.87	277.05	
12	190.26	217.95	204.22	198.44	217.06	226.82	229.27	233.97	210.44	229.08	295.81	

[a] Series was deflated by producer price index.

Source: Prices from Western Wood Products Association, 1982-1992, Coast F.O.B. price summary.

Table 5—Real yearly lumber prices, stumpage prices, and stumpage volumes for the Pacific Northwest west-side region[a]

Year	Lumber price[b]	Cut stumpage price[c]	Sold stumpage price	Volume sold	Volume cut
	1982 dollars per thousand board feet			*Thousand board feet*	
1910	107.72	16.04	18.57	103,315	48,869
1911	98.89	16.95	20.61	277,021	47,789
1912	95.06	16.94	19.23	161,924	66,869
1913	71.53	17.01	13.86	462,054	81,511
1914	68.98	16.66	13.31	226,471	134,490
1915	88.53	15.76	24.21	574,920	91,792
1916	73.17	12.88	7.87	212,524	136,344
1917	80.42	9.06	7.79	982,891	186,391
1918	83.17	8.21	7.74	174,798	174,608
1919	103.17	7.57	10.18	128,007	196,229
1920	130.03	6.62	6.93	254,241	200,721
1921	107.31	11.55	11.10	179,383	219,273
1922	125.69	12.55	10.25	427,573	276,263
1923	155.60	12.27	14.51	1,771,536	362,768
1924	130.87	13.96	12.20	704,390	288,829
1925	117.51	12.52	12.16	626,520	396,364
1926	116.92	14.98	15.43	243,163	428,681
1927	118.14	14.43	14.01	197,618	410,838
1928	114.01	15.26	16.90	1,187,134	580,864
1929	122.25	15.63	16.10	360,961	472,495
1930	113.56	15.60	21.80	2,119,716	466,234
1931	95.93	17.08	14.87	97,291	267,091
1932	94.85	17.80	16.02	60,174	112,394
1933	119.40	17.69	14.10	62,558	218,952
1934	125.06	17.80	12.63	94,401	243,796
1935	115.84	16.30	12.49	109,867	287,332
1936	127.01	16.34	13.84	115,287	356,532
1937	132.40	16.71	11.61	782,248	510,128
1938	127.72	17.76	16.74	420,578	394,691
1939	134.82	20.43	17.34	966,385	596,853
1940	143.98	18.91	17.25	503,724	798,470
1941	169.13	16.88	21.31	519,717	981,030
1942	155.90	18.97	23.75	1,451,914	833,490
1943	158.20	23.97	28.61	1,359,729	1,221,695
1944	170.00	26.44	26.92	816,430	1,488,714
1945	169.04	25.97	25.69	879,216	1,084,952
1946	170.21	22.04	25.54	974,088	1,216,512
1947	250.69	20.73	33.50	1,558,841	1,670,027
1948	264.31	28.07	50.23	1,642,766	1,651,115
1949	243.17	37.14	32.41	846,061	1,367,124
1950	287.47	38.00	47.15	1,843,894	1,889,740
1951	281.62	37.89	52.46	1,795,011	2,071,363
1952	285.47	53.00	59.88	1,895,640	1,793,505
1953	265.78	54.09	47.39	2,015,868	2,446,031
1954	267.53	66.55	52.94	2,404,300	2,585,792
1955	292.08	55.64	89.87	2,860,450	2,729,885

Table 5—Real yearly lumber prices, stumpage prices, and stumpage volumes for the Pacific Northwest west-side region[a] (continued)

Year	Lumber price[b]	Cut stumpage pricec	Sold stumpage price	Volume sold	Volume cut
	1982 dollars per thousand board feet			*Thousand board feet*	
1956	281.27	76.47	84.72	2,866,708	2,734,073
1957	243.75	70.79	57.89	2,708,171	2,510,106
1958	233.59	58.43	45.09	4,371,075	3,098,855
1959	264.25	60.90	75.09	3,978,955	4,240,155
1960	244.66	64.64	69.37	3,838,996	3,564,265
1961	233.54	61.36	58.28	3,977,154	3,807,968
1962	238.81	57.61	52.13	4,177,965	4,433,500
1963	244.81	56.74	54.85	6,106,964	4,703,641
1964	247.89	57.90	76.02	4,351,960	5,021,350
1965	241.35	62.54	84.41	4,475,081	5,419,568
1966	246.64	75.94	93.71	4,738,054	4,728,453
1967	248.00	75.81	82.85	4,429,621	4,669,607
1968	288.44	96.03	120.96	4,765,354	5,313,214
1969	306.92	112.85	157.21	4,597,362	4,892,582
1970	243.74	92.68	68.90	5,420,074	4,102,027
1971	290.47	95.15	72.27	4,594,177	4,351,692
1972	324.72	109.93	122.80	4,988,845	5,333,643
1973	384.71	107.01	206.91	4,606,352	5,369,612
1974	305.03	106.49	234.06	4,818,713	4,385,398
1975	257.67	100.56	157.97	5,058,665	3,764,556
1976	306.87	137.67	170.60	3,624,211	4,395,839
1977	334.02	163.72	216.16	4,662,779	4,113,597
1978	351.97	177.91	248.41	4,841,413	4,514,199
1979	360.58	172.21	319.81	5,364,878	4,383,455
1980	293.37	139.60	283.64	5,326,651	3,489,424
1981	237.16	120.86	213.37	5,294,720	2,978,762
1982	198.43	75.04	72.75	4,957,031	2,458,220
1983	217.29	94.58	95.16	4,959,340	4,287,477
1984	205.49	92.16	75.95	4,907,598	4,669,179
1985	205.99	84.30	72.55	4,268,325	4,760,461
1986	212.72	96.67	101.05	5,782,606	5,257,908
1987	225.19	110.93	125.52	4,921,661	5,440,796
1988	233.03	142.34	158.51	4,907,311	5,506,143
1989	244.77	150.60	188.61	2,427,368	4,968,472
1990	226.12	160.49	239.37	4,876,402	3,495,481
1991	222.97	175.48	144.52	1,041,372	2,867,845
1992	255.94	198.24	183.85	751,042	1,964,806

[a] Prices are deflated by producer price index.

[b] Lumber prices 1910-72 from USDA (1973); lumber prices 1973-92 are coast Douglas-fir prices from the Western Wood Products Association, 1982-1992, Coast F.O.B. price summary, Portland, Oregon.

[c] Cut and sold prices and volume 1910-92 are from Pacific Northwest Region National Forest timber sales data. Specific information relating to series construction can be obtained from the authors.

Table 6—Seasonal correction factors[a]

Month	Lumber	Cut stumpage[b]	New orders[c]	Inventory
1	0.97	1.14	1.03	0.99
2	.99	1.06	.91	1.03
3	1.01	1.03	1.16	1.04
4	1.03	1.01	1.05	1.04
5	1.03	.94	1.07	1.01
6	1.05	.97	1.08	.96
7	1.04	.92	.90	.97
8	1.02	.92	.94	.96
9	1.00	.92	1.05	.99
10	.97	1.04	1.02	1.01
11	.96	1.05	.89	1.02
12	.95	1.00	.94	.97

[a] Except where noted, these factors were derived by using a standard econometric software package to correct for the seasonality.

[b] The correction factors were taken directly from Haynes 1991, table 7.

[c] New orders and inventory data come from Western Woods Products Association, 1982-1993, Western Lumber Facts.

Sohngen, Brent L.; Haynes, Richard W. 1994. The "great" price spike of '93: an analysis of lumber and stumpage prices in the Pacific Northwest. Res. Pap. PNW-RP-476. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 20 p.

Lumber prices for coast Douglas-fir (*Psuedotsuga menziesii* (Mirb.) Franco var. *menziesii*) swung rapidly from a low of $306 per thousand board feet (MBF) in September 1992 to a high of $495/MBF in March 1993. This price spike represented a sizable increase in the value of lumber over a short period, but it was not the historical anomaly that many in the media would suggest. Using the theoretical relation between lumber and stumpage prices, we analyzed the interaction between these two markets over the past 82 years. Among our major findings were that there are distinct seasonal variations in monthly lumber and stumpage prices; over the longer term, these markets can be divided into three different periods—1910 to 1944, 1945 to 1962, and 1963 to 1992; the most recent price spike did not match previous spikes in real terms; and the traditional lumber and stumpage price interaction became more significant with time but it does not seem to be as pronounced when we look at monthly prices.

Keywords: Price, price spike, stumpage, Douglas-fir, seasonality.

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